



**United Nations
Environment
Programme**

Distr.
GENERAL

UNEP/OzL.Pro/ExCom/78/4
6 March 2017



ORIGINAL: ENGLISH

EXECUTIVE COMMITTEE OF
THE MULTILATERAL FUND FOR THE
IMPLEMENTATION OF THE MONTREAL PROTOCOL
Seventy- eighth Meeting
Montreal, 4-7 April 2017

**AVAILABLE INFORMATION ON HFC CONSUMPTION AND PRODUCTION
IN ARTICLE 5 COUNTRIES**

Background

1. In the context of agenda item 10 on Issues relevant to the Executive Committee arising from the Twenty-eighth Meeting of the Parties to the Montreal Protocol of the 77th meeting,¹ the Executive Committee requested the Secretariat to prepare a document containing preliminary information in response to the elements in decision XXVIII/2 addressing, among others, available information on HFC consumption and production, as well as on HFC-23 by-product, including from surveys of ODS alternatives funded by the Multilateral Fund and other sources (decision 77/59(b)(i)).

2. This document consists of the following sections:

Section I HFC production and consumption analysis based on Technology and Economic Assessment Panel (TEAP) Task Force reports under decisions XXV/5 and XXVI/9

Section II Preliminary information on HFC consumption from the ODS alternatives surveys² and other sources

3. The document also contains the following Annexes:

Annex I HFC production and consumption data contained on the TEAP Task Force reports under decisions XXV/5 and XXVI/9

¹ Montreal, Canada, 28 November – 2 December 2016.

² Includes surveys submitted by 27 February 2017 by the following 30 Article 5 countries: Albania, Argentina, Bolivia (Plurinational State of), Bosnia and Herzegovina, Chile, Colombia, Costa Rica, Dominican Republic, Ecuador, El Salvador, Guatemala, Honduras, Kenya, Lebanon, Madagascar, Mexico, Montenegro, Nicaragua, Oman, Panama, Paraguay, Republic of Moldova, Senegal, Serbia, South Sudan, Swaziland, The Former Yugoslav Republic of Macedonia, Uganda, Uruguay and Zimbabwe.

Annex II Information on HFC consumption from ODS alternatives survey reports from 30 Article 5 countries

Section I: HFC production and consumption analysis based on TEAP Task Force reports

4. Aggregate production and consumption of HFCs in Article 5 countries has been made available to the Parties to the Montreal Protocol through the reports prepared by the TEAP Task Forces under decisions XXV/5 and XXVI/9.

Production sector

5. Based on these reports, the aggregated global production of HFCs in 2015 was estimated at 314,515 metric tonnes (mt) of HFCs, consisting of 98,500 mt of HFC-125; 71,000 mt of HFC-32; 17,000 mt of HFC-143a and 126,000 mt of HFC-134a.³ As a reference, the HCFC baseline for production in Article 5 countries amounted to 501,266 mt (with the production of one country amounting to 430,962 mt). A substantial proportion of HFC-32 and HFC 125 was used for the production of HFC blends mainly R-410A,⁴ R-407C,⁵ R-404A,⁶ R-407F⁷ and R-507,⁸ with the former three constituting a significant proportion of the total HFC blends currently used.

6. HFC-23 generated in the production of HCFC-22 in Article 5 countries has been emitted or destroyed, except for a small amount that was consumed in refrigeration, fire suppression, plasma-etching processes in semiconductor manufacturing or as a feedstock for producing other chemicals. HFC-23 emission data is difficult to obtain as most HFC-23 has been emitted as a waste gas. Based on the Article 7 data reporting, in 2015, the HFC-23 by-product from ODS production in six Article 5 countries (Argentina, China, Democratic People's Republic of Korea, India, Mexico and Bolivarian Republic of Venezuela) was estimated at 7,357 mt; and additional HFC-23 generated from HCFC-22 feedstock production in China, India and Mexico was 8,142 mt.⁹

Consumption sector

7. HFC consumption in Article 5 countries is estimated to increase from 284,326 mt in 2015 to 1,021,216 mt in 2030 under a business-as-usual scenario,¹⁰ with over 95 per cent of the consumption in the refrigeration and air-conditioning sector. As a reference, the HCFC baseline for consumption in Article 5 countries amounted to 538,749 mt, with one country consuming 292,656 mt (i.e., over 54 per cent of the aggregated consumption). Over 99 per cent of the HCFC consumption was by three HCFCs: HCFC-22, representing the only HCFC used by all Article 5 countries (395,413 mt); HCFC-141b (107,971 mt); and HCFC-142b (31,580 mt).

8. The Secretariat noted the following from the consumption trends projected in the TEAP reports:¹¹

- (a) As of 2010, HFC-134a constituted the highest proportion of HFC consumption in mt followed by R-410A and R-407C. However, by 2030, the estimated consumption of R-410A will constitute the highest proportion of HFC consumption followed by R-407C

³ TEAP Task Force Report on Decision XXVI-9 Additional Information on Alternatives to ODS.

⁴ HFC-32 (50 per cent), HFC-125 (50 per cent).

⁵ HFC-32 (23 per cent), HFC-125 (25 per cent), HFC-134a (52 per cent).

⁶ HFC-125 (44 per cent), HFC-143a (52 per cent), HFC-134a (4 per cent).

⁷ HFC-32 (30 per cent), HFC-125 (30 per cent), HFC-134a (40 per cent).

⁸ HFC-125 (50 per cent), HFC-143a (50 per cent).

⁹ A detailed analysis of HFC-23 is contained in document UNEP/OzL.Pro/ExCom/78/9.

¹⁰ The business-as-usual scenario of the TEAP did not consider the Kigali Amendment

¹¹ For this report, R-404A and R-507 which was an aggregate figure in the TEAP report is presented as 50 per cent each of the combined total, and similarly for use of HFC-134a and HFC-152a in the foam sector.

and HFC-134a. This is due to the high growth rate of R-410A and R-407C in the air-conditioning sector on account of HCFC phase-out;

- (b) HFC-134a consumption, in mt, is expected to grow in the next 20 years at a rate of 6 per cent in the refrigeration and air-conditioning (RAC) sector, followed by metered dose inhalers (MDI) applications and the foam sector. RAC applications including mobile air-conditioning (MAC) is expected to account for more than 90 per cent of the total HFC-134a consumption;
- (c) The growth in consumption of R-410A, R-407C, R-404A, R-507, HFC-152a, HFC-245fa, and HFC-365mfc/HFC-227ea, in mt, over the next 20 years is estimated to be more than 10 per cent, mainly due to the conversion from HCFCs to HFC-based technologies in refrigeration, air-conditioning and foam applications. Consumption of HFC-152a, HFC-245fa, and HFC-365mfc/HFC-227ea is less than 2 per cent in mt even as of 2030; and
- (d) Based on its global warming potential (GWP), in CO₂ equivalent terms, in year 2010, R-410A accounted for the highest proportion of HFC consumption closely followed by HFC-134a. Consumption of R-407C, R-404A and R-507 were in the range of 10-12 per cent of the total consumption. By 2030, R-410A is estimated to constitute the highest proportion of the consumption followed by R-407C, R-507, R-404A and HFC-134a.

9. There is an increase in alternative technologies that are becoming commercially available in local markets in Article 5 countries (i.e., HFC-32, CO₂, NH₃, and HFOs mainly as refrigerant and as foam blowing agents), where further optimization and commercialization could impact the future demand for HFCs. Furthermore, estimates show that HFC consumption in blends (e.g., R-410A, R-407C) is higher than HFC consumption as a pure substance (e.g., HFC-134a). A number of HFC blends are being researched and are likely to be adopted in different end-user applications. These blends may contain one or more of the HFCs listed in Annex F to the Kigali amendment.

Section II: Preliminary information on HFC consumption available from ODS alternatives survey and other sources

10. At its 74th and 75th meetings, the Executive Committee approved the preparation of national surveys for ODS alternatives for 127 countries, 31 of which had been received as at 27 February 2017.¹² Eleven reports were from non-low volume consuming (LVC) countries and 20 from LVC countries (i.e., two from West Asia, eight from Africa, six from Europe and Central Asia, and 15 from Latin America). Annex II to the present document presents summary tables on aggregated HFC consumption from the 30 reports that were submitted. A comprehensive report with potentially all the 127 surveys funded under the Multilateral Fund will be submitted to the 79th meeting.

11. Based on the ODS surveys from the 30 Article 5 countries a total of 16 HFCs (pure) and 30 HFC blends, with GWPs ranging from 124 to 14,800, are currently used. For most of the countries, consumption was mainly HFC-134a, R-410A, R-404A, R-407C, and R-507A, and mainly used in refrigeration and air-conditioning applications. For LVCs, the consumption was mainly used in servicing and/or installation/charging of refrigeration and air-conditioning equipment. The consumption of pure HFCs except for HFC-134a was reported to be quite low, while the HFCs contained in blends appeared to be higher (i.e., share of HFC-32, HFC-125, HFC-134a, and HFC-143a contained in R-410A, R-404A, R-407C);

¹² Fifteen ODS survey reports were completed, while 16 provided only data on ODS alternatives consumption without the full report; analysis of 30 reports are provided as one country (African region) submitted preliminary and incomplete data.

12. In 2015, total HFC consumption (pure and blends) for the 30 countries was reported to be 42,077 mt. All countries reported consumption of HFC-134a, R-410A, R-404A; 28 countries reported consumption of R-407C, 23 reported consumption of R-507A; 11 countries reported consumption of HFC-152a; and only three countries reported consumption of (pure) HFC-32 for refrigeration servicing. In addition, 18 countries reported the consumption of other blends (two reporting more than 12 blends). The main HFCs and HFC-blends in these countries are summarized in Table 1.

Table 1. Main HFCs and HFC-blends consumed in 30 Article 5 countries

HFC	% of total	Annual growth rate*	Uses
HFC-134a	40	7	Domestic and commercial refrigeration and MAC; with small uses in other RAC applications, foam and MDIs
HFC-410A	26	23	Air-conditioning applications
R-404A	7	5	Low temperature refrigeration applications
R-507A	2	23	RAC sector
R-407C	1	11	Air-conditioning applications
HFC-152a**	8	33	Industrial aerosol sector and extruded polystyrene foam
HFC-245fa***	9	9	PU foam
Others	6	35	Small uses in all applications
Total	100	13	

(*) Calculated as compounded annual growth rate (CAGR) between 2012 and 2015, referred to in the document as “annual growth rate.”

(**) Over 90 per cent of this consumption was reported for only one country.

(***) One country reported a high use of HFC-245fa for the PU foam sector (i.e., around 15 per cent of its total HFC consumption)

13. HFC consumption in foam sector constituted around 10 per cent of the total HFC consumption, increasing from 2,883 mt in 2012 to 3,983 mt in 2015, with an annual growth rate of 11 per cent. The main HFCs consumed in the production of polyurethane (PU) foam included HFC-134, HFC-134a, HFC-152a, HFC-245fa, HFC-365mfc alone, and HFC-227ea/HFC-365mfc, with HFC-245fa constituting more than 95 per cent of consumption in mt (in one country, consumption of HFC-245fa represented 15 per cent of its total HFC consumption). HFC-134a and HFC-152a were also consumed for the production of extruded polystyrene (XPS) foam, with the consumption increasing from 268 mt in 2012 to 289 mt in 2015, with an annual growth rate of only 3 per cent.

14. HFC consumption was reported in aerosol, fire-fighting and solvents applications representing about 11 per cent of the total consumption in 2015. A brief overview of HFC consumption in these applications is given below, noting that a large number of HFC free alternatives were also used in this sector:

- (a) HFCs consumed in aerosol applications included HFC-134a, HFC-152a, HFC-227ea and HFC-365mfc/227ea, used in industrial aerosols (90 per cent) and MDIs (10 per cent consuming HFC-134a and HFC-227ea) applications. The consumption grew from 1,855 mt in 2012 to 4,116 mt, with an annual growth rate of 30 per cent;
- (b) HFCs consumed in solvents included HFC-125, HFC-134a, HFC-152a, HFC-218, HFC-227ea, and HFC-43-10mee. The consumption grew from 20.7 mt in 2012 to 29.7 mt in 2015, with an annual growth rate of 13 per cent; and

- (c) HFCs consumed in fire-fighting included HFC-125, HFC-365mfc, HFC-227ea, HFC-227ea/HFC-365mfc, HFC-23 and HFC-236fa, with consumption of HFC-125, HFC-227ea, and HFC-365mfc constituting more than 98 per cent of the total consumption. The consumption grew from 152 mt in 2012 to 352 mt in 2015, with an annual growth rate of 32 per cent.

Observations from the review of surveys on ODS alternatives

15. In reviewing the HFC data provided in the surveys on ODS alternatives,¹³ the Secretariat had the following broad observations:

- (a) Some reports provided consumption data without specifying the sub-sector for which the HFC substance was used particularly in the refrigeration in servicing sector (e.g., MAC or domestic refrigeration);
- (b) Several of the reports did not provide breakdown of the specific sub-sector uses for each HFC and, therefore, a more detailed analysis of the distribution of HFC consumption per sector and sub-sector could not be done;
- (c) Several of the reports submitted included only the tables with HFC consumption data, which did not allow for an analysis of the methodology used, the forecast and trends in consumption. Complete reports will be finalized and submitted prior to the 79th meeting;
- (d) As the current licensing systems in all countries except for one do not include controls for the import/export of HFCs, countries provided only best estimates of HFC consumption; therefore, cross-checking was difficult; and
- (e) While some countries provided a forecast of HFC consumption, an overall projection was not possible due to limited number of data available (only four years from 2012 to 2015), major fluctuations in consumption, the consumption of new HFCs and/or HFC-blends during the reporting period. On this basis, forecasting HFC consumption for base years would need to consider other factors (such as the forecast of HCFCs, analysis on the trend of new technologies based on controlled substances being introduced, population growth rate and rate of population with access to refrigeration and air-conditioning equipment including automobiles).

Recommendation

16. The Executive Committee may wish to note the document UNEP/OzL.Pro/ExCom/78/4 on Available information on HFC consumption and production in Article 5 countries.

¹³ Due to the small sample size and the fact that the TEAP data was not disaggregated by country, it was not possible to compare HFC consumption data collected from the ODS alternatives surveys and that provided by the TEAP

Annex I

INFORMATION ON THE CONSUMPTION OF HFCs (TEAP TASK FORCES REPORTS)

HFC consumption in Article 5 countries by substance and sector

Particulars	HFC consumption (mt)					Per cent of total				
	2010	2015	2020	2025	2030	2010	2015	2020	2025	2030
RAC										
HFC-134a	54,393	74,524	100,162	127,267	161,107	43.5%	27.3%	21.9%	18.2%	16.5%
R-410A	40,975	106,661	192,770	284,682	364,845	32.8%	39.1%	42.1%	40.8%	37.3%
R-407C	16,543	55,278	101,216	174,433	285,500	13.2%	20.3%	22.1%	25.0%	29.2%
R-404A	6,543	18,202	31,982	55,964	83,845	5.2%	6.7%	7.0%	8.0%	8.6%
R-507	6,543	18,202	31,982	55,964	83,845	5.2%	6.7%	7.0%	8.0%	8.6%
Total RAC	124,997	272,867	458,112	698,310	979,142	100.0%	100.0%	100.0%	100.0%	100.0%
Foam										
HFC-134a	478	3,364	5,669	11,280	15,225	36.5%	31.6%	30.5%	35.1%	37.2%
HFC-152a	478	3,364	5,669	11,280	15,225	36.5%	31.6%	30.5%	35.1%	37.2%
HFC-245fa	354	2,172	3,840	4,986	5,504	27.0%	20.4%	20.6%	15.5%	13.4%
HFC-365mfc/ HFC-227ea	0	1,758	3,428	4,546	5,020	0.0%	16.5%	18.4%	14.2%	12.3%
Total foam	1,310	10,658	18,606	32,092	40,974	100.0%	100.0%	100.0%	100.0%	100.0%
MDI										
HFC-134a	700	800	900	1,000	1,100	100.00%	100.00%	100.00%	100.00%	100.00%
Total MDI	700	800	900	1,000	1,100	100.0%	100.0%	100.0%	100.0%	100.0%
Total by HFC										
HFC-134a	55,571	78,688	106,731	139,547	177,432	43.8%	27.7%	22.3%	19.1%	17.4%
R-410A	40,975	106,661	192,770	284,682	364,845	32.3%	37.5%	40.4%	38.9%	35.7%
R-407C	16,543	55,278	101,216	174,433	285,500	13.0%	19.4%	21.2%	23.8%	28.0%
R-404A	6,543	18,202	31,982	55,964	83,845	5.2%	6.4%	6.7%	7.7%	8.2%
R-507	6,543	18,202	31,982	55,964	83,845	5.2%	6.4%	6.7%	7.7%	8.2%
HFC-152a	478	3364	5669	11280	15225	0.4%	1.2%	1.2%	1.5%	1.5%
HFC-245fa	354	2172	3840	4986	5504	0.3%	0.8%	0.8%	0.7%	0.5%
HFC-365mfc/ HFC-227ea	55	1758	3428	4546	5020	0.0%	0.6%	0.7%	0.6%	0.5%
Grand total	127,007	284,325	477,618	731,402	1,021,216	100.0%	100.0%	100.0%	100.0%	100.0%
Total RAC	124,997	272,867	458,112	698,310	979,142	98.4%	96.0%	95.9%	95.5%	95.9%
Total foam	1,310	10,658	18,606	32,092	40,974	1.0%	3.7%	3.9%	4.4%	4.0%
Total MDI	700	800	900	1000	1100	0.6%	0.3%	0.2%	0.1%	0.1%

Note: There may be minor differences due to round-off of numbers.

Distribution of HFC consumption in Article 5 countries by sector and subsector

Sectors	Substance	HFC consumption (mt)				
		2010	2015	2020	2025	2030
Domestic	HFC-134a	12,941	13,329	15,333	18,242	21,634
Commercial	HFC-134a	2,743	5,089	9,356	11,910	15,018
Commercial	R-404A	5,672	15,696	27,753	48,912	74,142
Commercial	R-507	5,672	15,696	27,753	48,912	74,142
Industrial	HFC-134a	720	1,320	2,255	3,730	6,074
Industrial	R-404A	300	1,567	3,133	5,485	7,607
Industrial	R-507	300	1,567	3,133	5,485	7,607
Transport	HFC-134a	544	1,075	1,982	2,608	3,104
Transport	R-404A	572	941	1,096	1,568	2,098
Transport	R-507	572	941	1,096	1,568	2,098
SAC	HFC-134a	1,091	2,315	4,556	5,849	7,087
SAC	R-410A	40,975	106,661	192,770	284,682	364,845
SAC	R-407C	16,543	55,278	101,216	174,433	285,500
MAC	HFC-134a	36,354	51,396	66,680	84,928	108,190
Foam	HFC-134a	478	3,364	5,669	11,280	15,225
Foam	HFC-152a	478	3,364	5,669	11,280	15,225
Foam	HFC-245fa	354	2,172	3,840	4,986	5,504
Foam	HFC-365mfc/ HFC-227ea	0	1,758	3,428	4,546	5,020
MDI	HFC-134a	700	800	900	1,000	1,100
Total		127,009	284,329	477,618	731,404	1,021,220
Manufacturing						
Domestic	HFC-134a	11,234	12,812	14,610	17,323	20,540
Commercial	HFC-134a	2,617	4,779	8,726	10,874	13,551
Commercial	R-404A	4,608	10,402	15,515	26,206	38,395
Commercial	R-507	4,608	10,402	15,515	26,206	38,395
Industrial	HFC-134a	406	650	1,040	1,663	2,661
Industrial	R-404A	119	807	1,266	1,986	2,218
Industrial	R-507	119	807	1,266	1,986	2,218
Transport	HFC-134a	321	551	948	964	981
Transport	R-404A	439	621	579	830	1,145
Transport	R-507	439	621	579	830	1,145
Air conditioning	HFC-134a	862	1,587	2,923	3,072	3,229
Air conditioning	R-410A	34,583	82,577	134,702	178,540	206,625
Air conditioning	R-407C	6,107	26,645	43,128	69,810	112,998
MAC	HFC-134a	25,061	32,577	40,822	52,100	66,495
Foam	HFC-134a	478	3,364	5,669	11,280	15,225
Foam	HFC-152a	478	3,364	5,669	11,280	15,225
Foam	HFC-245fa	354	2,172	3,840	4,986	5,504
Foam	HFC-365mfc/ HFC-227ea	0	1,758	3,428	4,546	5,020
MDI	HFC-134a	700	800	900	1,000	1,100
Total		93,533	197,296	301,125	425,482	552,670
Servicing						
Domestic	HFC-134a	1,707	517	723	919	1,094
Commercial	HFC-134a	126	310	630	1,036	1,467
Commercial	R-404A	1,064	5,294	12,238	22,706	35,747

Sectors	Substance	HFC consumption (mt)				
		2010	2015	2020	2025	2030
Commercial	R-507	1,064	5,294	12,238	22,706	35,747
Industrial	HFC-134a	314	670	1,215	2,067	3,413
Industrial	R-404A	181	760	1,867	3,499	5,389
Industrial	R-507	181	760	1,867	3,499	5,389
Transport	HFC-134a	223	524	1,034	1,644	2,123
Transport	R-404A	133	320	517	738	953
Transport	R-507	133	320	517	738	953
Air conditioning	HFC-134a	229	728	1,633	2,777	3,858
Air conditioning	R-410A	6,392	24,084	58,068	106,142	158,220
Air conditioning	R-407C	10,436	28,633	58,088	104,623	172,502
MAC	HFC-134a	11,293	18,819	25,858	32,828	41,695
Total		33,476	87,033	176,493	305,922	468,550
Grand total						
RAC		124,999	272,871	458,112	698,312	979,146
Foam		1,310	10,658	18,606	32,092	40,974
MDI		700	800	900	1,000	1,100
Total		127,009	284,329	477,618	731,404	1,021,220
Manufacturing						
RAC		91,523	185,838	281,619	392,390	510,596
Foam		1,310	10,658	18,606	32,092	40,974
MDI		700	800	900	1000	1100
Total		93,523	197,296	301,125	425,482	552,670
Servicing						
RAC		33,476	87,033	176,493	305,922	468,550
Total		33,476	87,033	176,493	305,922	468,550
RAC manufacturing		91,523	185,838	281,619	392,390	510,596
Refrigeration servicing		33,476	87,033	176,493	305,922	468,550
RAC total		124,999	272,871	458,112	698,312	979,146

Note: There may be minor differences due to round-off of numbers.

Estimates of distribution of HFC consumption in Article 5 countries by substance in CLP¹⁴

Sectors	Substance	CLP	2010	2015	2020	2025	2030
Domestic	HFC-134a	1.000	12,941	13,329	15,333	18,242	21,634
Commercial	HFC-134a	1.000	2,743	5,089	9,356	11,910	15,018
Commercial	R-404A	2.743	15,558	43,054	76,126	134,166	203,372
Commercial	R-507	2.786	15,802	43,729	77,320	136,269	206,560
Industrial	HFC-134a	1.000	720	1,320	2,255	3,730	6,074
Industrial	R-404A	2.743	823	4,298	8,594	15,045	20,866
Industrial	R-507	2.786	836	4,366	8,729	15,281	21,193
Transport	HFC-134a	1.000	544	1,075	1,982	2,608	3,104
Transport	R-404A	2.743	1,569	2,581	3,006	4,301	5,755
Transport	R-507	2.786	1,594	2,622	3,053	4,368	5,845
SAC	HFC-134a	1.000	1,091	2,315	4,556	5,849	7,087
SAC	R-410A	1.460	59,824	155,725	281,444	415,636	532,674
SAC	R-407C	1.241	20,530	68,600	125,609	216,471	354,306
MAC	HFC-134a	1.000	36,354	51,396	66,680	84,928	108,190
Foam	HFC-134a	1.000	478	3,364	5,669	11,280	15,225
Foam	HFC-152a	0.087	42	293	493	981	1,325
Foam	HFC-245fa	0.720	255	1,564	2,765	3,590	3,963
Foam	HFC-365mfc/HFC-227ea	1.000	0	1,758	3,428	4,546	5,020
MDI	HFC-134a	1.000	700	800	900	1,000	1,100
Total			172,403	407,277	697,299	1,090,202	1,538,309
HFC-134a			55,571	78,688	106,731	139,547	177,432
R-410A			59,824	155,725	281,444	415,636	532,674
R-407C			20,530	68,600	125,609	216,471	354,306
R-404A			17,950	49,934	87,727	153,512	229,992
R-507			18,232	50,716	89,102	155,918	233,598
Others			351	3,615	6,686	9,117	10,307
Manufacturing							
Domestic	HFC-134a	1.000	11,234	12,812	14,610	17,323	20,540
Commercial	HFC-134a	1.000	2,617	4,779	8,726	10,874	13,551
Commercial	R-404A	2.743	12,640	28,533	42,558	71,883	105,317
Commercial	R-507	2.786	12,838	28,980	43,225	73,010	106,968
Industrial	HFC-134a	1.000	406	650	1,040	1,663	2,661
Industrial	R-404A	2.743	326	2,214	3,473	5,448	6,084
Industrial	R-507	2.786	332	2,248	3,527	5,533	6,179
Transport	HFC-134a	1.000	321	551	948	964	981
Transport	R-404A	2.743	1,204	1,703	1,588	2,277	3,141

¹⁴ CLP presents relative value of the climate impact potential of a substance compared with that of HFC-134a which is assigned a reference value of 1.

Sectors	Substance	CLP	2010	2015	2020	2025	2030
Transport	R-507	2.786	1,223	1,730	1,613	2,312	3,190
SAC	HFC-134a	1.000	862	1,587	2,923	3,072	3,229
SAC	R-410A	1.460	50,491	120,562	196,665	260,668	301,673
SAC	R-407C	1.241	7,579	33,066	53,522	86,634	140,231
MAC	HFC-134a	1.000	25,061	32,577	40,822	52,100	66,495
Foam	HFC-134a	1.000	478	3,364	5,669	11,280	15,225
Foam	HFC-152a	0.087	42	293	493	981	1,325
Foam	HFC-245fa	0.720	255	1,564	2,765	3,590	3,963
Foam	HFC-365mfc/HFC-227ea	1.000	0	1,758	3,428	4,546	5,020
MDI	HFC-134a	1.000	700	800	900	1,000	1,100
Total			128,608	279,771	428,494	615,159	806,872
Servicing							
Domestic	HFC-134a	1.000	1,707	517	723	919	1,094
Commercial	HFC-134a	1.000	126	310	630	1,036	1,467
Commercial	R-404A	2.743	2,919	14,521	33,569	62,283	98,054
Commercial	R-507	2.786	2,964	14,749	34,095	63,259	99,591
Industrial	HFC-134a	1.000	314	670	1,215	2,067	3,413
Industrial	R-404A	2.743	496	2,085	5,121	9,598	14,782
Industrial	R-507	2.786	504	2,117	5,201	9,748	15,014
Transport	HFC-134a	1.000	223	524	1,034	1,644	2,123
Transport	R-404A	2.743	365	878	1,418	2,024	2,614
Transport	R-507	2.786	371	892	1,440	2,056	2,655
SAC	HFC-134a	1.000	229	728	1,633	2,777	3,858
SAC	R-410A	1.460	9,332	35,163	84,779	154,967	231,001
SAC	R-407C	1.241	12,951	35,534	72,087	129,837	214,075
MAC	HFC-134a	1.000	11,293	18,819	25,858	32,828	41,695
Foam	HFC-134a	1.000	-	-	-	-	-
Foam	HFC-152a	0.087	-	-	-	-	-
Foam	HFC-245fa	0.720	-	-	-	-	-
Foam	HFC-365mfc/HFC-227ea	1.000	-	-	-	-	-
MDI	HFC-134a	1.000	-	-	-	-	-
Total			43,794	127,506	268,805	475,043	731,436
Grand total							
RAC			170,928	399,499	684,044	1,068,805	1,511,676
Foam			774	6,979	12,355	20,397	25,532
MDI			700	800	900	1,000	1,100
Total			172,403	407,277	697,299	1,090,202	1,538,309
Manufacturing							
RAC			127,134	271,993	415,239	593,761	780,240
Foam			774	6,979	12,355	20,397	25,532

Sectors	Substance	CLP	2010	2015	2020	2025	2030
MDI			700	800	900	1,000	1,100
Total			128,608	279,771	428,494	615,159	806,872
Servicing							
RAC			43,794	127,506	268,805	475,043	731,436
Foam			-	-	-	-	-
MDI			-	-	-	-	-
Total			43,794	127,506	268,805	475,043	731,436
RAC manufacturing			127,134	271,993	415,239	593,761	780,240
Refrigeration servicing			43,794	127,506	268,805	475,043	731,436
RAC total			170,928	399,499	684,044	1,068,805	1,511,676

Annex II

INFORMATION ON THE CONSUMPTION OF HFCs (ODS ALTERNATIVES SURVEY)
HFC consumption from 30 Article 5 countries by substance and sector

Substance	HFC consumption (mt)				Per cent of total				Annual growth rate
	2012	2013	2014	2015	2012	2013	2014	2015	
RAC									
HFC-32	2.13	5.55	0.51	3.97	0.0%	0.0%	0.0%	0.0%	23.1%
HFC-134a	9,588.56	9,206.71	11,307.53	10,744.29	48.6%	39.4%	37.7%	38.4%	3.9%
HFC-152a	1.03	0.47	2.37	2.07	0.0%	0.0%	0.0%	0.0%	26.2%
HFC-227ea	7.00	-	-	-	0.0%	0.0%	0.0%	0.0%	0%
HFC-143a	4.26	3.44	3.24	0.75	0.0%	0.0%	0.0%	0.0%	-44.0%
HFC-23	0.82	0.80	0.24	2.09	0.0%	0.0%	0.0%	0.0%	36.6%
Other pure HFCs	9.01	14.49	-	-	0.0%	0.1%	0.0%	0.0%	0%
R-404A	2,458.23	2,654.29	3,340.21	2,882.66	12.5%	11.4%	11.2%	10.3%	5.5%
R-407C	386.84	426.12	541.71	524.01	2.0%	1.8%	1.8%	1.9%	10.6%
R-410A	6,010.26	9,581.86	12,344.18	11,244.73	30.5%	41.0%	41.2%	40.2%	23.2%
R-507A	510.76	621.99	1,486.72	956.73	2.6%	2.7%	5.0%	3.4%	23.3%
Other blends	754.89	858.94	929.84	1,627.13	3.8%	3.7%	3.1%	5.8%	29.2%
Total RAC	19,733.79	23,374.66	29,956.55	27,988.43	100.00%	100.00%	100.00%	100.00%	12.4%
MAC									
HFC-134a	4,038.02	4,590.96	4,886.96	5,228.42	100.00%	100.00%	100.00%	100.00%	9.0%
Total MAC	4,038.02	4,590.96	4,886.96	5,228.42	100.0%	100.0%	100.0%	100.0%	9.0%
Foam									
HFC-134a	161.61	148.24	154.55	166.6	5.1%	3.9%	4.0%	3.9%	1.0%
HFC-152a	165.80	169.2	215.6	199.1	5.3%	4.4%	5.6%	4.6%	6.3%
HFC-245fa	2,816.99	3,406.32	3,397.52	3,609.73	89.4%	89.6%	87.8%	83.7%	8.6%
HFC-365mfc	7.10	27.1	8.3	133.28	0.2%	0.7%	0.2%	3.1%	165.8%
Other pure HFCs	-	51.14	89.4	183.17	0.0%	1.3%	2.3%	4.2%	0.0%
Other blends	-	0.8	5.1	19.9	0.0%	0.0%	0.1%	0.5%	0.0%
Total Foam	3,151.50	3,802.80	3,870.47	4,311.78	100.00%	100.00%	100.00%	100.00%	11.0%
Solvents									
HFC-134a	3.48	4.51	4.59	5.53	16.8%	14.9%	42.3%	18.7%	16.7%
HFC-152a	-	0.20	1.75	3.24	0.0%	0.7%	16.1%	10.9%	0.0%
HFC-227ea	2.51	2.85	2.93	4.10	12.1%	9.4%	27.0%	13.8%	17.8%
Other pure HFCs	14.69	22.65	1.57	16.78	71.0%	75.0%	14.5%	56.6%	4.5%
Total Solvents	20.68	30.21	10.84	29.65	100.0%	100.0%	100.0%	100.0%	12.8%
Firefighting									
HFC-227ea	106.38	74.23	75.94	116.93	70.0%	46.3%	53.7%	33.2%	3.2%
HFC-365mfc	4.80	14.40	4.80	20.00	3.2%	9.0%	3.4%	5.7%	60.9%
HFC-125	21.15	17.54	34.25	139.24	13.9%	11.0%	24.2%	39.6%	87.4%
HFC-23	-	-	-	0.10	0.0%	0.0%	0.0%	0.0%	0.0%
HFC-236fa	19.04	53.14	23.57	73.24	12.5%	33.2%	16.7%	20.8%	56.7%
HFC-227ea/HFC-365mfc	0.60	0.85	2.93	2.48	0.4%	0.5%	2.1%	0.7%	60.5%
Total Firefighting	151.97	160.16	141.49	351.99	100.0%	100.0%	100.0%	100.0%	32.3%
Aerosol									
HFC-134a	596.42	662.84	768.14	879.93	32.2%	25.3%	22.5%	21.4%	13.8%
HFC-152a	1,257.66	1,954.65	2,634.03	3,214.07	67.8%	74.5%	77.1%	78.1%	36.7%
HFC-227ea	0.82	5.04	13.09	14.98	0.0%	0.2%	0.4%	0.4%	163.4%
Other pure HFCs	-	-	-	7.20	0.0%	0.0%	0.0%	0.2%	0.0%
Total Aerosol	1,854.90	2,622.53	3,415.26	4,116.18	100.0%	100.0%	100.0%	100.0%	30.4%

Substance	HFC consumption (mt)				Per cent of total				Annual growth rate
	2012	2013	2014	2015	2012	2013	2014	2015	
Other applications									
HFC-134a	9.45	0.07	2.56	9.04	0.5%	0.0%	0.1%	0.2%	-1.5%
HFC-152a	53.60	67.05	22.60	39.78	2.9%	2.6%	0.7%	1.0%	-9.5%
HFC-23	-	0.02	-	0.06	0.0%	0.0%	0.0%	0.0%	0.0%
R-507A	-	-	-	1.64	0.0%	0.0%	0.0%	0.0%	0.0%
Total Other applications	63.05	67.14	25.16	50.52	3.4%	2.6%	0.7%	1.2%	-7.1%
Total by HFC									
HFC-23	0.82	0.82	0.24	2.25	0.0%	0.0%	0.0%	0.0%	40.0%
HFC-32	2.13	5.55	0.51	3.97	0.0%	0.0%	0.0%	0.0%	23.1%
HFC-125	21.15	17.54	34.25	139.24	0.1%	0.1%	0.1%	0.3%	87.4%
HFC-134a	14,397.54	14,613.33	17,124.33	17,033.81	49.6%	42.2%	40.5%	40.5%	5.8%
HFC-143a	4.26	3.44	3.24	0.75	0.0%	0.0%	0.0%	0.0%	-44.0%
HFC-152a	1,478.09	2,191.57	2,876.35	3,458.26	5.1%	6.3%	6.8%	8.2%	32.8%
HFC-227ea	116.71	82.12	91.96	136.01	0.4%	0.2%	0.2%	0.3%	5.2%
HFC-236fa	19.04	53.14	23.57	73.24	0.1%	0.2%	0.1%	0.2%	56.7%
HFC-245fa	2,816.99	3,406.32	3,397.52	3,609.73	9.7%	9.8%	8.0%	8.6%	8.6%
HFC-365mfc	11.90	41.50	13.10	153.28	0.0%	0.1%	0.0%	0.4%	134.4%
HFC-227ea/HFC-365mfc	0.60	0.85	2.93	2.48	0.0%	0.0%	0.0%	0.0%	60.5%
Other pure HFCs	23.70	88.28	90.97	207.15	0.1%	0.3%	0.2%	0.5%	106.0%
R-404A	2,458.23	2,654.29	3,340.21	2,882.66	8.5%	7.7%	7.9%	6.9%	5.5%
R-407C	386.84	426.12	541.71	524.01	1.3%	1.2%	1.3%	1.2%	10.6%
R-410A	6,010.26	9,581.86	12,344.18	11,244.73	20.7%	27.7%	29.2%	26.7%	23.2%
R-507A	510.76	621.99	1,486.72	958.37	1.8%	1.8%	3.5%	2.3%	23.3%
Others blends	754.89	859.74	934.94	1,647.03	2.6%	2.5%	2.2%	3.9%	29.7%
GRAND TOTAL	29,013.91	34,648.46	42,306.73	42,076.97	100.0%	100.0%	100.0%	100.0%	13.2%
Total RAC	19,733.79	23,374.66	29,956.55	27,988.43	68.0%	67.5%	70.8%	66.5%	12.4%
Total MAC	4,038.02	4,590.96	4,886.96	5,228.42	13.9%	13.3%	11.6%	12.4%	9.0%
Total Foam	3,151.50	3,802.80	3,870.47	4,311.78	10.9%	11.0%	9.1%	10.2%	11.0%
Total Solvents	20.68	30.21	10.84	29.65	0.1%	0.1%	0.0%	0.1%	12.8%
Total Firefighting	151.97	160.16	141.49	351.99	0.5%	0.5%	0.3%	0.8%	32.3%
Total Aerosol	1,854.90	2,622.53	3,415.26	4,116.18	6.4%	7.6%	8.1%	9.8%	30.4%
Total Other applications	63.05	67.14	25.16	50.52	0.2%	0.2%	0.1%	0.1%	-7.1%